SNDT Women's University, Mumbai

Bachelor of Science (Microbiology)

B.Sc. (Microbiology)

As Per NEP - 2020

Syllabus

(2024-2025)

Credit structure For Under Graduate Programmes in Humanities, Science and Technology and Interdisciplinary Studies Faculties
(2024 May as per GR dated 13/03/2024)

	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total
Subject No 1 (to be treated as Major)	4		12	12	8	10	**46**
Subject No 2 (A and B), so minor	2	2	2		4	4	**14**
Subject No 3		4					**4**
VSC S1	2				2		**4**
VSC S2		2					**2**
VSC S3		2					**2**
Major (Elective)					4	4	**8**
OEC	4	4	2	2			**12**
SEC	2	2		2			**6**
AEC (English)	2	2	2	2			**8**
AEC (Modern Indian Language)			2	2			**4**
VEC	2	2					**4**
CC	2	2	2	2			**8**
IKS (Generic)	2						**2**
IKS (Major-Specific)					2		**2**
FP					2		**2**
OJT						4	**4**
	22	**22**	**22**	**22**	**22**	**22**	**132**

Terminologies

Abbreviation	Full-form	Remarks	Related to Major and Minor Courses
Major (Core)	Main Discipline		
Major (Elective)	Elective Options		related to the Major Discipline
Minor Stream	Other Disciplines (Inter/ Multidisciplinary) not related to the Major	either from the same Faculty or any other faculty	
OEC	Open Elective Courses/ Generic		Not Related to the Major and Minor
VSC	Vocational Skill Courses		Related to the Major and Minor
SEC	Skill Enhancement Courses		Not Related to the Major and Minor
AEC	Ability Enhancement Courses	Communication skills, critical reading, academic writing, etc.	Not Related to the Major and Minor
VEC	Value Education Courses	Understanding India, Environmental science/education, Digital and technological solutions, Health & Wellness, Yoga education, sports, and fitness	Not Related to the Major and Minor
IKS	Indian Knowledge System	I. Generic IKS Course: basic knowledge of the IKS II. II. Subject-Specific IKS Courses: advanced information about the subject: part of the major credit	Subject Specific IKS related to Major
OJT	On-Job Training (Internship/Apprenticeship)	corresponding to the Major Subject	Related to the Major
FP	Field projects	corresponding to the Major Subject	Related to the Major
CC	Co-curricular Courses	Health and Wellness, Yoga education sports, and fitness, Cultural Activities, NSS/NCC and Fine/ Applied/Visual/ Performing Arts	Not Related to the Major and Minor
CE	Community Engagement and service		Not Related to the Major and Minor
RP	Research Project	corresponding to the Major Subject	Related to the Major

Programme Template

Programme Degree		B.Sc.
Parenthesis		Microbiology
Preamble		Microbiology is a branch of science that deals with study of microorganisms. The microbiological study has wide scope ranging from basic sciences to applied sciences. The prominent applied branches of microbiology that can be focused on Pharmaceutical microbiology, agricultural microbiology, food microbiology, environmental microbiology, medical microbiology, industrial microbiology and epidemiology. Various job opportunities are available for the students in the sector of industry, academia and government as well as non- government research institutes. Student can work as research fellow at various National Institutes, as Assistant Professor in colleges and Laboratory Technicians at Government and private pathological laboratories.
Programme Specific Outcomes (PSOs)		After completing this programme, Learners will be able to
	1.	Apply knowledge and technical skills as they investigate broad variety of contemporary subjects covering different areas of microbiology.
	2.	Acquire critical thinking skills like hypothesis creation and testing, experiment design and execution, read and interpret scientific literature and demonstrate good written and oral communication via presentations.
	3.	Gain proficiency in skills needed for environmental sustainability
	4.	Enable students to go for higher studies in microbiology and allied subjects leading to post graduation and Ph.D. Degrees
	5.	Get employed at various National Institutes, academic institutes and Government and private pathological laboratories
	6.	Exemplify the diversity in the microbial world and evaluate their ecological role as well as state their significance to humankind.
	7.	Classify and characterize microorganisms based on their morphological, cultural, biochemical, and molecular properties
Eligibility Criteria for Programme		1. Female candidates with 12th Science in PCB Pass out (*Note: Admissions will be based on Merit)*
Intake		The Program is offered at affiliated Colleges of SNDTWU.

Structure with Course Titles

B.Sc. Microbiology

SN	Courses	Type of Course	Credits	Marks	Int	Ext
	Semester I					
10032501	Fundamentals of Microbiology-Part A Theory	Major (Core)	2	50	50	0
		Major (Core)	2	50	0	50
		Major (Core)	2	50	50	0
10432511	Microbiology in Everyday Life	OEC	4	100	50	50
10632501	Basic Skills of Microbiological Laboratory (Practical)	VSC	2	50	50	0
10732501	Computer Applications	SEC	2	50	50	0
	English - I	AEC (English)	2	50	0	50
	Inception of India Knowledge System	IKS (Generic)	2	50	0	50
		VEC	2	50	0	50
	Co-curricular activity	CC	2	50	50	0
			22	**550**	**300**	**250**
	Semester II					
20032511	Fundamentals of Microbiology-Part B Theory	Major (Core)	2	50	0	50
		Major (Core)	2	50	50	0
		Major (Core)	2	50	0	50
		VSC	2	50	0	50
		VSC	2	50	0	50
20432511	Microbial infections and human defense mechanisms	OEC	4	100	50	50
20732501	Food fermentation techniques (Practical)	SEC	2	50	50	0
	English -II	AEC (English)	2	50	50	0
		VEC	2	50	0	50
	Co-curricular activity	CC	2	50	50	0
			22	**550**	**250**	**300**

Exit with UG Certificate with 4 extra credits (44 + 4 credits)

Course Syllabus

Semester I

1.1 Major (Core)

Course Title	Fundamentals Of Microbiology-Part A (Theory)
Course Credits	2
Course Out comes	After going through the course, learners will be able to
	1. Elucidate the process of formation of earth and evolution of microorganisms on earth. 2. Summarize the key events in the history of microbiology 3. Recognize the scope and relevance of microbiology 4. Illustrate the nature, correlate function of components that make up a prokaryotic cell and identify them microscopically. 5. Compare and contrast between structural features of prokaryotic and eukaryotic cell
Module 1 (Credit1) - History, Introduction & Scope Of Microbiology	
Learning Outcomes	After learning the module, learners will be able to:
	1. Comprehend the scope of microbiology
Content Outline	• Introduction and discovery of microorganisms, • Scope and relevance of microbiology, • Future of microbiology
Module 2 (Credit1) - Prokaryotic Cell Structure and functions	
Learning Outcomes	After learning the module, learners will be able to:
	1. Analyse the ultrastructure of the cell and different components of cell.
Content Outline	• Cell wall, Cell membrane, Components external to cell wall- Capsule, Flagella, Pili, Fimbriae, Cytoplasmic matrix-ribosomes, gas vesicles. Nucleoid, Bacterial endospores and their formation

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

1. Poster presentation on topics such as Contribution of Scientists in discovery of microorganisms, Scope of Microbiology in various fields and Future of microbiology

2. Draw the ultrastructure of prokaryotic cell showing various internal and external components of cell
   Expected outcomes: Identify and describe prokaryotic cell structure and understand the functions of cell constituents

3. Schematic representation of formation of bacterial endospore

References:

1. Michael J. Pelczar Jr., E.C.S. Chan, Noel R. Krieg, Microbiology TMH 5th Edition, 2001.

2. Prescott, Hurley, Klein-Microbiology, 9th edition, International edition, McGraw Hill, 2013.

3. Michael T. Madigan & J. M. Martin, Brock, Biology of Microorganisms 11th Ed. International edition, Pearson Prentice Hall, 2006.

4. 4. Cruikshank, Medical Microbiology, Vol-II, reprint. Publisher, Churchill Livingstone, 1975.

5. Kathleen Park Talaro & Arthur Talaro - Foundations in Microbiology, 11th edition McGraw Hill. 2006

6. Tortora, Funke and Case, Microbiology-an Introduction, 10th Edition, Benjamin-Cummings Publishing Company, 2009.

7. M. Madigan, J. Martinko, J. Parkar, "Brock Biology of microorganisms", 12th ed., Pearson Education International, 2009.

8. Tortora G.J. Microbiology: An Introduction, Benjamin Cumming Corp.1st edition, 2008.

9. J.C.H. Steele, Clinics in laboratory medicine, Emerging Infections and their causative agents. vol 24, issue 3, September 2004

10. Ananthnarayan & Paniker, Textbook of Microbiology, 8th edition, 2009

11. Godkar Praful, Medical laboratory technology, 2nd edition, 2006

1.4 Open Elective Courses/ Generic (OEC)

Course Title	Microbiology In Everyday Life (Theory)
Course Credits	4
Course Out comes	After going through the course, learners will be able to
	1. Cite examples of various types of useful and harmful microorganisms and their ubiquitous nature. 2. Discuss the applications of microorganisms in various fields. 3. Classify the microorganisms into different types and compare their characteristic features. 4. Specify the use of microorganisms in day-to-day life 5. Differentiate between different types of host- microbe interactions. Compare and contrast between air- borne and water-borne infections, food borne, zoonotic and vector borne infections
Module 1 (Credit1) - **Introduction to Microbiology**	
Learning Outcomes	After learning the module, learners will be able to:
	1. Cite examples of various types of useful and harmful microorganisms and their ubiquitous nature 2. Classify the microorganisms into different types and compare their characteristic features.
Content Outline	• Introduction, Definition of Microbiology, Useful microorganisms, Harmful microorganisms, Microorganisms are everywhere (ubiquitous nature of microorganisms), Applications in various fields. • Types of Microorganisms: Bacteria (including actinomycetes), Archaea, Fungi, Algae, Protozoa and Viruses
Module 2(Credit1) - Microbiologist and microbes in day to day life	
Learning Outcomes	After learning the module, learners will be able to:
	1. Evaluate the role of a microbiologist to solve a range of problems affecting humans and nature
Content Outline	• Role of Microbiologists- to solve a range of problems affecting our health, environment, food, agriculture and defense. • Microbes used in day-to-day life, Use of sanitizers and disinfectants, Role of antimicrobials in toothpaste and cosmetics, antimicrobial activity of kitchen spices, Role of microorganisms in making fermented food like curd, idli and dosa. Role of microorganisms in spoilage of food.
Module 3 (Credit1) - Human- Microbe Interactions	

Learning Outcomes	After learning the module, learners will be able to:.
	1. Describe the normal flora of the human body. Define the various types of associations between host and microorganisms.
Content Outline	• Microorganisms residing on and in human body: Importance of normal flora • Normal flora of skin, gastrointestinal tract, genitourinary tract, respiratory tract • Immune - privileged sites: eye, brain, reproductive system • Associations: symbiosis, parasitism, commensalism
Module 4 (Credit 1) - Host defense against infections	
Learning Outcomes	After learning the module, learners will be able to:
	1. Give examples of different pathogens. 2. Cite the significance of immuneprivileged sites in the human body
Content Outline	• Importance of Public Health Microbiology • Microorganisms infecting our body when immunity lowers down skin infections, disorders of the digestive system • Infections of our body after visiting a hospital- Respiratory tract infection • Pathogens infecting our body through air- Upper and Lower Respiratory tract infections • Pathogens infecting our body through contaminated water- Disorders of the gastro- intestinal system

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

1) Introduction to Microbiology:

a) Brief overview of microbiology and its significance in different fields.
b) Discussion on the role of microbiologists in solving real-world problems.

2) Microbes in Daily Life:

a) Interactive session exploring the ubiquitous presence of microbes in our Surroundings.
b) Examples of beneficial microbes used in everyday products and processes.

3) Understanding Sanitizers and Disinfectants:

a) Demonstration on the use and efficacy of sanitizers and disinfectants.
b) Discussion on the importance of hygiene in preventing microbial infections.

4) Exploring Antimicrobials in Products:

a) Presentation on the role of antimicrobials in toothpaste and cosmetics.
b) Group activity: Analyzing labels of personal care products to identify

Antimicrobial ingredients.

5) The Science of Kitchen Spices:

a) Experiment: Testing the antimicrobial activity of common kitchen spices.
b) Discussion on how these spices inhibit microbial growth and enhance food Safety.

6) Microbial Fermentation:

a) Hands-on activity: Making yogurt (curd) using microbial fermentation.
b) Explanation of the role of microorganisms in the fermentation process.

7) Understanding Food Spoilage:

a) Presentation on the causes and types of food spoilage.
b) Group discussion: Strategies to prevent food spoilage using microbial Control methods.

References:

1. Bender K.S., Buckley D. H., Stahl D. A., Sattley W. M. And Madigan M. T. (2017). Brock Biology of Microorganisms. E-Book, Global Edition. United Kingdom: Pearson Education.

2. Dubey H. C. (2004). A textbook of fungi, bacteria and Viruses. Vikas Publishing House Private Limited. New Delhi, India

3. Dubey R. C. and D. K. Maheshwary. (2012). A textbook of Microbiology. S Chand and Company. New Delhi, India

4. Goettel M. S. and Wilcks A. (2012). Beneficial Microorganisms in Agriculture, Food and the Environment: Safety Assessment and Regulation. United Kingdom: CAB International.

5. Jain A. and Jain P. (2019). Essentials of Microbiology. Elsevier- India.

6. Ananthanarayan and Paniker's Textbook of Microbiology. 10th edition. Universities Press, Hyderabad, India

7. Klein D. A., Harley J. P. And Prescott L. (2001). Microbiology. United Kingdom: McGrawHill Higher Education.

8. Lagerkvist U. (2003). Pioneers of Microbiology and The Nobel Prize. Singapore: World Scientific Publishing Company.

9. Mehrotra R. S. (2009). Principles of Microbiology. India: McGraw-Hill Education (India) Private Limited.

10. Mishra B. B. and Nayak S. K. (2020). Frontiers in Soil and Environmental Microbiology. United States: CRC Press.

11. Pareek R. P. and Pareek N. (2019). Agricultural Microbiology. Scientific Publishers, Jodhpur, Rajasthan, India

12. Sherwood L., Woolverton C. J. and Willey J. (2016). Prescott's Microbiology. Singapore: McGraw-Hill Education.

13. Stanier R. Y. (2003). General Microbiology. United Kingdom: Palgrave Macmillan Limited.

14. Subba Rao N. S. (2016). Advances in Agricultural Microbiology. Netherlands: Elsevier Science.

1.5 Vocational Skill Courses (VSC)

Course Title	Basic Skills Of Microbiology Laboratory (Practical)
Course Credits	2
Course Out comes	After going through the course, learners will be able to 1. Handle and use microscope, autoclave, biosafety cabinets, and incubator. 2. Prepare sterile zone for working in laboratory 3. Perform analysis of air, water and pharmaceutical preparations. 4. Evaluate effect of various factors affecting growth of microorganisms
Module 1 (Credit 1) -	
Learning Outcomes	After learning the module, learners will be able to:
	1. Understand the basic microbiology laboratory rules and good laboratory practices, principles of sterility, sterile zone and working in sterile zone. 2. Identify different parts of microscope and handling of microscope
Content Outline	• Microbiology Good Laboratory Practices and Biosafety. • Introduction to microscope and study of different aspects of microscope. • Preparation of sterile zone in the lab, working in aseptic area (between two burners) with precautions. • To study the principle and applications of important instruments (biological safety cabinets, autoclave, incubator, BOD incubator, hot air oven, light microscope, pH meter) used in the microbiology laboratory. • Microbiological analysis of air, water and some pharmaceutical preparations.
Module 2 (Credit 1) -	
Learning Outcomes	After learning the module, learners will be able to:
	1. Study the isolation, purification and characterization of microorganisms and understand factors affecting growth of microbes
Content Outline	• Measurement of size of microorganisms. • Counting the number of microorganisms/ml of the culture • Determination of Thermal Death Time • Factors affecting growth of organisms like temperature and pH. • Isolation of colonies, purification techniques and observation of colony characteristics using spread plate, pour plate and serial dilution methods.

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

References:

1.6 Skill Enhancement Courses (SEC)

Course Title	Computer Applications (Theory)
Course Credits	2
Course Outcomes	After going through the course, learners will be able to
	1. Study application of computers, types of computers computer hardware, computer code and arithmetic's, software component and data processing concepts 2. Enable the learners to understand concept basic anatomy of computers, central processing unit input and output device. 3. Enable the learners to understand in detail about Binary number system computer logic software component
Module 1 (Credit 1) -	
Learning Outcomes	After learning the module, learners will be able to:
	1. Study basics of computers, present and future application of computer, types of computers and it's software and hardware.
Content Outline	• **Introduction:** Introduction to computers • **Historical development:** Present and future application of computers in everyday life and scientific research. • **Types of computers:** Mini, Micro, Mainframe, and Supercomputers. • **Computer hardware:** Components, Basic anatomy of computers, Central Processing Unit, Control Unit, Arithmetic Logic Unit, Memory devices, Input Devices, Output devices, Secondary storage devices. • **Computer codes and arithmetic's:** Binary number system, Fixed point and floating point numbers, Character data representation, ASCII codes, Computer logic, Boolean algebra, Truth tables, Logic gates. • **Software Components:** System software, Machine language, High-level languages. • **Data Processing Concepts :** Types of data processing , Online processing ,Time–sharing
Module2(Credit1) -	
Learning Outcomes	1. To study the concepts of computer connectivity, MS Office, internet and web.

Content Outline	• **Application software:** General purpose application, Word processors, Spread sheets, Database Management Systems, Presentation graphics, Software suits, Integrated packages. • **Communication and Connectivity:** Fax-machines, E-mail, Voice messing systems, Videoconferencing systems, Shared resources, Online services, User connection, Modems, Types of modems, Type connections, Communication channels, Telephone lines, Coaxil cable, Fiber optics cable ,Microwave, Satellite, Data transmission, Network architecture, Network types. • **The Internet and the Web:** Internet applications, Access, E-mail, E-commerce, Internet services, Browsers, Web pages, Search tools, Web utilities,, Organizational internets, Intranets and extranets. • **Multimedia and Web Authoring:** Multimedia ,Web authoring, Graphic programs, Virtual reality, Artificial intelligence, Project management • **Microsoft Word :** Application of Microsoft word • **Microsoft Excel/Analysis:** Use of Microsoft excel of preparation of data sheet, • **Microsoft Power Point:** Application of power point • **Statistical analysis:** Statistical application t-test, Regression Analysis, ANOVA

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

1. **Research Paper on Present and Future Applications of Computers:**
   - Conduct research on the current and potential future applications of computers in various fields such as healthcare, education, business, entertainment, and scientific research.

Write a research paper summarizing the findings, including examples of how computers are currently used and potential advancements in the future. Discuss the impact of emerging technologies such as artificial intelligence, machine learning, and quantum computing.

2. **Types of Computers and Software/Hardware Components:**
   - Create a presentation or infographic that illustrates the different types of computers (mini, micro, mainframe, supercomputers) and their respective applications.
   - Prepare a comparison chart highlighting the key features and differences between each type of computer.
   - Write a short essay/write up or report detailing the essential hardware and software components of a computer system, including CPU, memory, storage devices, input/output devices, and operating systems.

3. **Exploration of Application Software:**
   - Select two or three types of application software (e.g., word processors, spreadsheets, presentation graphics), conduct hands-on exploration and experimentation with each.

- Develop a series of short tutorials or demonstration videos showcasing how to perform common tasks using each application software, such as creating documents, analyzing data, and designing presentations.

4. Computer Connectivity and Internet Usage:

- Conduct a survey or interview to gather information about the usage of computer connectivity options and internet services among individuals in different demographics (e.g., age groups, professions, geographical locations).
- Analyze the survey results and prepare a report summarizing the findings, including trends, preferences, and challenges related to computer connectivity and internet usage.
- Develop a set of recommendations or best practices for optimizing computer connectivity and internet usage based on the survey findings.

5. Microsoft Office Applications Exploration:

- Design hands-on activities or exercises to familiarize participants with the basic features and functions of each Microsoft Office application.
- Participants will collaborate on practical projects or assignments using Microsoft Office tools, such as creating documents, spreadsheets, and presentations.

6. Internet and Web Technologies Workshop:

- Facilitate interactive discussions and hands-on activities to explore practical aspects of using the internet and web-based applications effectively and safely.

Submission Guidelines:

- Assignments can be submitted in various formats, including reports, presentations, infographics, videos, or online portfolios.
- Ensure clarity, coherence, and organization in presenting assignment tasks and findings.
- Encourage creativity, critical thinking, and active participation in completing the assignments.

Assessment Criteria:

- Depth of understanding demonstrated in exploring computer basics, types, software/hardware components, connectivity options, and internet/web technologies.
- Clarity and accuracy of explanations regarding the usage and practical applications of computer concepts and tools.
- Relevance and practicality of examples provided for illustrating concepts and applications.
- Creativity and professionalism in presenting assignment tasks and findings.
- Compliance with submission guidelines and formatting requirements.

References:

1. Introduction to computers by Satish Sahani
2. Computer Programs In Clinical and Laboratory Medicine by D.John Doyle
3. Computer Application by Sumita Arora
4. Study of Labsmart software

5. Introduction to computer applications by DrMauparnaNandan, Dr Ajay Sharm

Semester II

2.1 Major (Core)

Course Title	Fundamentals Of Microbiology-Part B (Theory)
Course Credits	2
Course Out comes	After going through the course, learners will be able to
	1. Recognize the process of formation of earth and evolution of microorganisms on earth and explain the same. 2. Summarize the key events in the history of microbiology 3. Identify the scope and relevance of microbiology 4. Recall and explain the nature, correlate function of components that make up a prokaryotic cell and identify them microscopically. 5. Compare and contrast between structural features of prokaryotic and eukaryotic cell
Module 1 (Credit1) - Microbial Nutrition, Cultivation, Isolation & Preservation	
Learning Outcomes	After learning the module, learners will be able to:.
	1. Recall the nutritional requirements of microorganisms 2. Categorize and detect them in various samples
Content Outline	• Nutritional requirements for microorganisms – Carbon, Oxygen, Hydrogen, Nitrogen, Phosphorus, Sulfur and growth factors, • Types of Culture media, Isolation techniques of microorganisms and pure culture techniques, • Methods of preservation of microorganisms
Module 2 (Credit 1) - Microorganisms – In the Lab and in Nature	
Learning Outcomes	After learning the module, learners will be able to:
	1. Distinguish the principles of nutrition, cultivation and preservation of microorganisms.

Content Outline	1. Methods of preparation of various types of Culture Media: a) Liquid medium (Nutrient Broth) b) Solid Media (Nutrient agar, Sabourauds agar) c) Preparation of slant, butts and plates 2. Inoculation techniques and Study of Growth curve: a) Inoculation of Liquid Medium b) Inoculation of Solid Media (Slants, Butts and Plates) 3. Study of Colony Characteristics of Bacteria and pigmented Bacteria. 4. Study of Motility (Soft agar butt) 5. Use of Differential and Selective Media a) MacConkey agar b) Salt Mannitol Agar

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

1. Quizzes on Nutritional requirements and growth factors of microorganisms and sources of Carbon, Oxygen, Hydrogen, Nitrogen, Phosphorus, Sulfur.

2. Students will prepare culture media (liquid, solid) with household items, inoculate samples and document microbial growth.
   Expected outcomes: Understand microbial nutritional requirements an learn basic cultivation techniques

References:

1. Michael J. Pelczar Jr., E.C.S. Chan, Noel R. Krieg, Microbiology TMH 5th Edition, 2001.

2. Prescott, Hurley, Klein-Microbiology, 9th edition, International edition, McGraw Hill, 2013.

3. Michael T. Madigan & J. M. Martin, Brock, Biology of Microorganisms 11th Ed. International edition, Pearson Prentice Hall, 2006.

4. Cruikshank, Medical Microbiology, Vol-II, reprint. Publisher, Churchill Livingstone, 1975.

5. Kathleen Park Talaro & Arthur Talaro - Foundations in Microbiology, 11th edition McGraw Hill. 2006

6. Tortora, Funke and Case, Microbiology-an Introduction, 10th Edition, Benjamin-Cummings Publishing Company, 2009.

7. M. Madigan, J. Martinko, J. Parkar, "Brock Biology of microorganisms", 12th ed., Pearson Education International, 2009.

8. Tortora G.J. Microbiology: An Introduction, Benjamin Cumming Corp.1st edition, 2008.

9. J.C.H. Steele, Clinics in laboratory medicine, Emerging Infections and their causative agents. vol 24, issue 3, September 2004

10. Ananthnarayan & Paniker, Textbook of Microbiology, 8th edition, 2009

11. Godkar Praful, Medical laboratory technology, 2nd edition, 2006

2.6 Open Elective Courses/ Generic (OEC)

Course Title	Microbial infections and human defence mechanisms (THEORY)
Course Credits	4
Course Outcomes	After going through the course, learners will be able to
	1. Discuss how human body fights against infections. 2. Examine why some individuals fall ill more often? Outline types of hypersensitivity. 3. Differentiate between different types of vaccines. Explain in detail factors affecting infection 4. Infer the characteristics of probiotics for selection 5. Analyse various fermented products for their probiotic properties
Module 1 (Credit 1) - Basics of Infection Biology	
Learning Outcomes	After going through the course, learners will be able to, 1. To outline important terminologies in infection biology. 2. To analyze the different lines of immunological defense exhibited by human body.
Content Outline	• **Important terminology:** Primary infection, secondary infection. Contagious infection, occupational disorder, clinical infection, subclinical infection, Zoonoses, genetic disorder, vector borne infection. • **Factors affecting infection:** o Microbial factors: adherence, invasion, role of virulence factors in invasion, colonization & its effects. o Host factors: natural resistance, species resistance, racial resistance, individual resistance. o Why do some individuals fall more sick often?: Age, nutrition, personal hygiene, stress, hormones, Addiction to drugs/ alcohol. Interaction between Microbes & hosts is dynamic.
Module 2 (Credit 1) - Human system to fight infection	
Learning Outcomes	After going through the course, learners will be able to, 1. To classify the host and pathogen factors affecting infection
Content Outline	• First line of Defense: for skin, respiratory tract, gastrointestinal tract, genitourinary tract, eyes. • Second line of defense: Phagocytosis, Inflammation • Third line of defense: Brief introduction to antibody mediated & cell mediated immunity.

	• Inflammation and allergic reactions: Hallmarks of inflammation and types of hypersensitivity • Vaccines and Immunization schedule
Module 3 (Credit1) - Prebiotics	
Learning Outcomes	After going through the course, learners will be able to, 1. To define prebiotics 2. To evaluate the importance of gut microflora in maintaining good Health
Content Outline	• Concept, definition, criteria, history Probiotic microorganisms, safety of probiotic microorganisms, legal status of probiotics, Characteristics of Probiotics for selection. • Tolerance to additives, stability during storage, stability during passage to intestinal sites, minimum effective dose, maintenance of probiotic microorganisms
Module 4 (Credit1) - Probiotic microorganisms	
Learning Outcomes	After going through the course, learners will be able to, 1. To discuss role of probiotics in health and diseases
Content Outline	• Role of probiotics in health and disease: Prevention and treatment of gastro-intestinal bacterial infection. • Health benefits of Prebiotics, Mineral absorption, immune response, cancer prevention, IBD, elderly health and infant health

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

1. **Factors Affecting Infection**
   - Activity: Presentation on microbial factors affecting infection, including adherence, invasion, and virulence factors.
   - Discussion on host factors such as natural, species, racial, and individual resistance.
   - Explanation of why certain individuals are more susceptible to infections due to factors like age, nutrition, hygiene, stress, and lifestyle choices.
   - Methodology: Lecture, interactive discussion.
   - Expected Outcomes: Understanding the dynamic interaction between microbes and hosts, and awareness of factors influencing susceptibility to infections.

2. **Defence Mechanisms: First Line of Defence**
   - Activity: Presentation on the first line of defence mechanisms for various body systems (skin, respiratory tract, gastrointestinal tract, genitourinary tract, eyes).
   - Discussion on the role of physical barriers, mucosal surfaces, and resident microbiota in preventing infections.
   - Methodology: Lecture, visual aids.
   - Expected Outcomes: Understanding of the importance of the first line of defence in preventing microbial invasion and maintaining homeostasis.

3. **Defence Mechanisms: Second Line of Defense**

- Activity:Presentation on phagocytosis and inflammation as key components of the second line of defence.
- Demonstration of phagocytosis process using microscopy or animations.
- Methodology: Lecture, demonstration.
- Expected Outcomes: Understanding of how phagocytosis and inflammation contribute to the elimination of pathogens and tissue repair.

4. **Defence Mechanisms: Third Line of Defense and Immunology**
   - Activity:Brief introduction to antibody-mediated and cell-mediated immunity.
   - Explanation of the role of lymphocytes, cytokines, and immune memory in adaptive immunity.
   - Methodology: Lecture, visual aids.
   - Expected Outcomes: Basic understanding of adaptive immunity and the mechanisms underlying antibody and cell-mediated responses.

5. **Inflammation and Allergic Reactions**
   - Activity: Presentation on the hallmarks of inflammation and the types of hypersensitivity reactions.
   - Discussion on the immune mechanisms underlying allergies and autoimmune diseases.
   - Methodology: Lecture, case studies.
   - Expected Outcomes: Understanding of the inflammatory response and recognition of different types of hypersensitivity reactions.

6. **Vaccines and Immunization Schedule**
   - Activity: Overview of vaccines, including their concept, types, and sources.
   - Explanation of the importance of immunization schedules in preventing infectious diseases.
   - Methodology: Lecture, discussion.
   - Expected Outcomes: Familiarity with the principles of vaccination and awareness of the importance of immunization programs.

7. **Prebiotics and Probiotics**
   - Activity: Presentation on the concept, criteria, types, and sources of prebiotics and probiotics.
   - Discussion on the health benefits of prebiotics, including their effects on gut microflora, mineral absorption, immune response, and disease prevention.
   - Explanation of the characteristics of probiotics and their role in maintaining gut health.
   - Methodology: Lecture, case studies.
   - Expected Outcomes: Understanding of the potential health benefits of prebiotics and probiotics, and knowledge of their selection criteria and applications.

References:

1. Tortora, G.J., Funke, B.R., Case, C.L, 2016. Microbiology: An introduction. 12th Edition, Benjamin Pub. Co. NY

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3. Ananthnarayan, R. and C.E, Jayaram Panikar, 2020. Ananthnarayan and Panikar's Textbook of Microbiology, 10th edition, Universities Press.

4. Cruickshank K.R., 2005, Medical Microbiology Vol I & II Livingstone, Longman. (Topic II AND IV)

5. Chakraborty P. 2009, Textbook of Medical Parasitology, Central Publications, Kolkata,India.

6. Salminen. S and Wright, A. V. 1998. Lactic Acid Bacteria, Marcel Dekker

7. Glenn R. G. Marcel R. 2008. Handbook of Prebiotics CRC press

8. Lee Y K, Salminen S 2009. Handbook of Probiotics and Prebiotics. A John Willey and Sons Inc. Publication.

9. Sandholm T. M. Saarela M. 2003. Functional Dairy Products CRC Woodhead Publishing Ltd.

2.7 Skill Enhancement Courses (SEC)

Course Title	Food fermentation techniques (Practical)
Course Credits	2
Course Outcomes	After going through the course, learners will be able to
	1. Define different types of fermented foods
	2. Differentiate the types of fermented foods
	3. Identify various advantages and health benefits of fermented foods
	4. Identify various types of microorganisms involved in fermented foods
Module 1 (Credit 2) -	
Learning Outcomes	After learning the module, learners will be able to, **1.** Evaluate the role of microorganisms in food spoilage, preservation & production. **2.** Assess the microbiological quality of milk, study preservation of milk, production of cheese. **3.** Recognize the functioning of microbial industrial fermentations.
Content Outline	• Microbial fermentation for the production and estimation of amylase • Microbial fermentation for the production and estimation of citric acid • Microbial fermentation for the production and estimation of ethanol
Module 2 (Credit 2) -	
Learning Outcomes	After learning the module, learners will be able to, 1. Determine of the microbiological quality of milk sample by MBRT 2. Isolate different types of fungi from spoilt bread/fruits/vegetables
Content Outline	• Preparation of Yogurt/Dahi • Grading of Milk, DMC, Dye reduction test, Phosphatase test, SPC, LPC, • Coliform, psychrophilic and thermophilic counts in milk and milk products • Visit to a food industry/dairy unit / fermentation industry.

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

1. Select three specific microbial fermentations for the production and estimation of amylase, citric acid, and ethanol.

2. Chart preparation on various fermentation conditions required for optimal product yield, such as pH, temperature, substrate concentration, and aeration.

3. Compare and contrast the production and estimation methods for amylase, citric acid, and ethanol, highlighting their advantages, limitations, and potential applications in industrial settings.

4. Describe and demonstrate the following quality control tests for milk:
   a. Grading of Milk

b. DMC (Direct Microscopic Count)
c. Dye Reduction Test
d. Phosphatase Test
e. Standard Plate Count (SPC)
f. Lab Pasteurized Count (LPC)

5. Discuss the significance of microbiological analysis in monitoring the microbial quality and safety of dairy products.

6. Synopsis writing

7. Practical Unit test with experimental work

8. Spotting

References:

1. Hui YH, Meunier-Goddik L, Josephsen J, Nip WK, Stanfield PS (2004) Handbook of food and fermentation technology, CRC Press

2. Holzapfel W (2014) Advances in Fermented Foods and Beverages, Woodhead Publishing.

3. Yadav JS, Grover, S and Batish VK (1993) A comprehensive dairy microbiology, Metropolitan

4. Jay JM, Loessner MJ, Golden DA (2005) Modern Food Microbiology, 7th edition. Springer